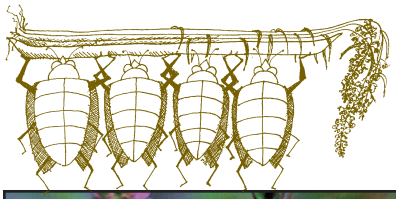


ACTIVITY 12 GRADES 6-8

NATURAL ENEMIES*

Objective
Students will create a "habitat" of prey and predators to study the relationships – who eats whom – in a food chain, in order to begin to understand what biological control is and how it works.

Time Suggestion
45 minutes.

Wisconsin Model Science Standards
Science: B.8.8, F.8.8.

DESCRIPTION

Students play a version of dominoes, using names of organisms instead of dots. By matching up prey with its predator, students get a preview of the food chain and are introduced to the concept of biological control. By matching a pest with its predator, the pest species can be controlled or managed.

PROBLEM

What are some prey and predator relationships and how can predators be used to help control prey if the prey is a pest species?

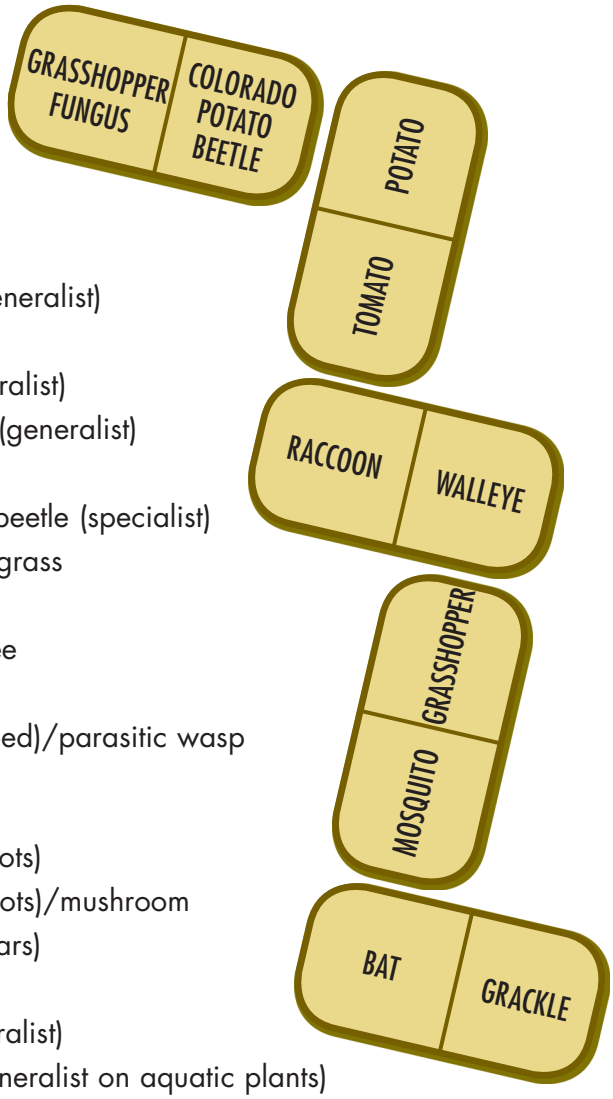
MATERIALS

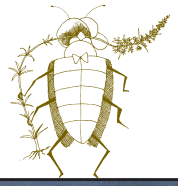
- ☐ A large, open area on the floor.
- ☐ Field guides.
- ☐ Per student, a copy of the list of card pairs (page 42).
- ☐ Per small group, one set of 34 4"x8" posterboard cards, each divided in half by a line and each end labeled in the pairs from the list on the next page.

PROCEDURES

1. Introduce the activity with a set of dominos, and tell the students that they will use a modified version of these to learn about why biocontrol works.
2. Project the card pair list onto a screen or wall and review the rules of the game, which are as follows:
   a. The cards begin in a stack on the floor, and each student starts with four cards.
   b. One student at a time picks a card and puts it into his/her card stack. The student then picks one card and positions it adjacent to the cards lined up on the floor so that the organism listed on one half of a card feeds upon or is fed upon by the organism on the card half that it is touching. Students may need to look up the type of food a particular organism might eat. Make sure students take into consideration the limitations or restrictions on each card.
   c. As each student adds a card, he or she must explain why that play is justified. Encourage students to use terms such as "predator," "parasite," "pathogen" (disease), "host," "herbivore," "carnivore," and "natural enemy."

- corn/soybean
- alfalfa/grass
- potato/cattail
- citrus tree/oak tree
- tomato/potato
- coyote (generalist)/elm tree
- apple tree/conifer aphid
- crayfish (generalist)/largemouth bass (generalist)
- algae/red fox (generalist)
- mosquito (generalist)/grasshopper (generalist)
- tomato hornworm (specialist)/honeybee (generalist)
- cow (generalist)/wildflower
- dragonfly (generalist)/caterpillar hunter beetle (specialist)
- lady beetle (generalist on small insects)/grass
- wheat/rose
- rose chafer beetle (specialist)/hickory tree
- milkweed/ant (generalist)
- monarch caterpillar (specialist on milkweed)/parasitic wasp (specialist on aphids)
- raccoon (generalist)/walleye (generalist)
- carrot/white grub (generalist on plant roots)
- underground root borer (generalist on roots)/mushroom
- deer/parasitic fly (generalist on caterpillars)
- wolf (generalist)/opossum (generalist)
- bat (generalist on insects)/grackle (generalist)
- loosestrife beetle (specialist)/muskrat (generalist on aquatic plants)
- soybean mosaic virus (specialist)/white-footed mouse (generalist)
- frog (generalist)/prickly pear moth (specialist)
- citrus virus (specialist)/cow tick (specialist)
- corn stalk borer (specialist)/cotton
- stalk borer parasite (specialist)/praying mantis (generalist)
- prickly pear cactus/hummingbird (generalist nectar feeder)
- bird louse (generalist on birds)/soybean pod borer (specialist)
- Colorado potato beetle (specialist)/grasshopper fungus (specialist)
- purple loosestrife/deerfly (generalist blood feeder)





d. If a student does not have a card that can be placed, the student passes. (Teachers might come up with simple rewards for students who run out of cards earliest.)

3. Play the game. As students add cards, the community of organisms illustrated by the game becomes more complex. Continue play until as many cards as possible have been played or a student uses up all of his/her cards.
4. Select an organism that is in play from each group, and tell the class to assume that it has become a pest. Choose a likely example (e.g., tomato hornworm), and ask, which of all the rest of the organisms in play are potential enemies of this pest? Suggest to students that, even though the natural enemies may not be touching the pest in the game, they could be manipulated by humans for possible use as biological control agents.
5. Have students put the cards away and return to their desks for final discussion.

Discuss examples of introduced predators that have become problematic, such as the Asian Lady Beetle (see **http://hort.uwex.edu/articles/multicolored-asian-lady-beetle/**).

Discuss how the numbers of a given predator, parasite, or disease organism affect the organism consumed. This relationship is the basis for the biological control of pests. As a class, develop a working definition of biological control, emphasizing that it involves the use of natural enemies by humans to help control or manage pests. Through biological control we increase the numbers and kinds of a pest's enemies so that the pest's numbers decrease. Classic biocontrol imports it's natural enemies.

BACKGROUND INFORMATION

Natural enemies fall into three basic categories: predators, parasitoids (parasites), and pathogens (disease). Predators are usually more general in their food habits and will feed on a wide variety of prey and are called generalists. Parasitoids, on the other hand, are considered specialists because they are likely to attack members of a certain group (e.g., moth caterpillars), a closely related group, or even a single species (e.g., gypsy moth caterpillar parasite). Pathogens may be generalists or specialists, depending upon the range of hosts that they attack.

Energy and materials flow from prey to their natural enemies, which, in turn are preyed upon by other organisms. Thus, many organisms are connected to one another in a series, much like links in a chain. Biologists call these food chains. Often, such food chains interact through many organisms that are found in more than one chain, creating what is called a food web. A particular food web is often typical of a particular kind of habitat.

Sometimes, however, a predator is adapted to eat only one prey organism (though it may itself be eaten by many other predators.) Usually, there is a special relationship between these predators and their prey. These predators are ideal candidates for use in biological control. Can you see why? The *Galerucella* beetles we use to help control purple loosestrife are this kind of organism. Though they will sometimes "taste" other plants, as far as we know they can complete their life cycle only if they have purple loosestrife to eat.[1] How does this make them ideal for our use even though they have been imported from another continent?

STUDENT ASSESSMENT

Each student takes a portion of the organisms from the above list and creates a food web, making it specific to a particular kind of ecosystem.

[1] Some strains of our biocontrol *Galerucella* beetles may also be able to complete their life cycle on one native plant that is very closely related to purple loosestrife (winged loosestrife) if it is growing in a purple loosestrife patch. Research suggests it is unlikely to be a problem.

* Revised with permission from "Natural Enemies: They're in the Cards," in *Biodiversity, Wetlands, and Biological Control: Information and Activities for Young Scientists*, by Michael R. Jeffords and Susan L. Post, (Chicago: Illinois Natural History Survey) 2000.